

## Written Testimony

Hearing: Subcommittee on Fisheries, Oceans and Insular Affairs, Oversight Hearing on Data Collection Issues in Relation to the Reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act.

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Date: 21 May 2013

I thank the Committee for the invitation to relate our experiences with cooperative research and how such research has been and can be incorporated into the fishery stock assessment and management processes.

### *Credentials*

I serve at the Virginia Institute of Marine Science (VIMS), which is the legally assigned marine research agency for the Commonwealth of Virginia as well as the degree-granting School of Marine Science at the College of William and Mary. Along with my research partners Dr. Robert J. Latour and Mr. James Gartland, we serve as Principal Investigators for the North East Area Monitoring and Assessment Program's (NEAMAP) Near Shore Fishery Independent Trawl Survey in the Mid-Atlantic and Southern New England waters. I have been directly involved in fishery independent monitoring surveys since 1981 and have been responsible for the design and supervision of such surveys since 2000.

### *NEAMAP Background*

Though the term NEAMAP is most often associated only with the Mid-Atlantic and Southern New England near shore trawl survey that we conduct, our survey is actually just one component under the larger, fishery-independent-surveys umbrella known as NEAMAP. NEAMAP was originally developed by the Atlantic States Marine Fisheries Commission (ASMFC) as a body to coordinate existing and future fishery-independent data collection efforts in the northeast and mid-Atlantic. Development of our survey was the first major task of NEAMAP to fill an appreciable gap in fishery-independent survey coverage in the coastal ocean between Cape Cod and Cape Hatteras.

Now that our survey is fully operational, the NEAMAP oversight committees are beginning to expand their efforts to serve other coordination roles. These expanded roles include such activities as:

- Identifying other gaps in survey coverage and developing new or expanding current data collection efforts to fill data needs.
- Exploring standardization of data parameters collected among surveys.
- Exploring and evaluating new technologies (e.g. underwater cameras, current meters, bottom mapping equipment) that would either increase or streamline data collection efforts.
- Ensuring that data from fishery independent surveys are available to and included in the stock assessment process to the greatest extent possible.
- Holding a multi-surveys workshop at which survey personnel will describe and demonstrate their onboard data collection systems. The goal is to begin a process of data integration among surveys.
- Beginning to develop a web site at which multiple surveys will house their abundance indices at a one-stop address.

### *Cooperative Fisheries Research*

The term "Cooperative Fisheries Research" represents a continuum of partnerships between fishermen and scientists which at the top end becomes "Collaborative Research" in which a full and constant

exchange of ideas takes place in an atmosphere of mutual respect with all parties understanding the goals of and the importance of the collaboration.

When planned and executed properly, cooperative research efforts can yield results beyond answering the original scientific question. Being the perpetual and well-motivated students of natural processes that fishermen are, they will often make observations about phenomena which even an experienced scientist would never have considered. In a collaborative atmosphere, the scientists can take these observations which might otherwise be dismissed as “anecdotal information” and form testable scientific hypotheses.

Most often, cooperative research efforts are relatively short term (1-3 years) projects designed to answer specific questions (e.g. to develop new fishing gear to reduce by-catch). In the Northeast, these projects are funded by the Cooperative Research Unit at the Northeast Fisheries Science Center. A number of excellent projects have been funded from that Unit.

Less common, at least on the East Coast, are long-term monitoring programs conducted as cooperative or collaborative ventures. To the best of my knowledge, out of approximately 20 trawl-based estuarine and marine fishery-independent surveys on this coast, only two such programs exist:

- The Maine/ New Hampshire Inshore Trawl Survey.  
This survey has operated since 2000 in the near coast waters of Maine and New Hampshire. Funding is annual and has rotated among the Northeast Consortium, NOAA Cooperative Research, and Congressional line item funding. The survey now operates under the NEAMAP umbrella described above.
- The NEAMAP Mid-Atlantic and Southern New England Near Shore Trawl Survey.  
This is the survey which my partners and I operate. A full description of the survey and its funding is provided below. In many of my comments that follow, I will refer to our survey using the “NEAMAP” moniker even though the entire NEAMAP program encompasses a broader set of surveys.

#### *NEAMAP Mid-Atlantic and Southern New England Near Shore Trawl Survey*

After successful completion of a pilot survey in the fall of 2006, funding was stitched together to begin full scale operations in the fall of 2007. Since then we have conducted two surveys per year, one in the spring and one in the fall, timed to complement but not to precisely match the federal surveys. At the completion of our current spring 2013 survey, we will have completed six spring and six fall surveys. For many species, we are just now reaching the point at which our time series is long enough to reveal any underlying trends in abundance, or other biological characteristics, and to compare those trends with data from other sources.

As previously mentioned, our survey covers the near shore waters between Cape Cod and Cape Hatteras. In the mid-Atlantic region our survey covers a strip of water between the 20ft. and 60ft. contours, which corresponds to a region that extends from just beyond the shoreline to between 3 and 25 miles offshore. In Southern New England we sample waters between 60ft. and 120ft., or to about 20 miles offshore (Figure 1). Most of these regions cannot presently be sampled by the federal surveys conducted by the Northeast Fisheries Science Center due to the depth restrictions of the large survey vessel used since 2009. While the total sampling area of our survey is small compared to the federal survey, the zones that we sample are heavily used by both fish and fishermen and without data such as

ours, assessments would suffer and managers would lack important data upon which to base their actions.

Both on the scientific side and our industry partners, Capt. James Ruhle, his sons, and his crew, we have worked hard to make our survey a truly collaborative venture. Nurturing such a relationship requires an ongoing effort. Our NEAMAP survey was not designed by ASMFC to necessarily be a cooperative research program. It is our good fortune that it became one.

Data from our survey are viewed as being valuable and unbiased not only by scientists but by most members of both the commercial and recreational communities as well. Several factors contribute to that perception:

- We underwent an extensive and very positive peer review process in 2008.
- Both scientists and industry members know and trust that we and Capt. Ruhle will uphold the strictest standards for how our fishing gear is deployed and how data are collected.
- We have strived to be as transparent as possible and have conducted numerous 'demo days' during which we invite citizens, press, local, state, and federal office holders, NGOs, and others to spend part of a day on our survey vessel to observe every detail of our data collection efforts. To date, approximately 300 individuals have direct experience observing our operations.

It is worth special attention to note that the NEAMAP mid-Atlantic / Southern New England survey is unique in that it not only is a prime example of collaborative research but that it is housed at an academic institution. All other large scale multi-species fishery independent monitoring surveys of which I am aware are operated by state or federal agencies (other academic or private entities do conduct monitoring surveys but they tend to be very localized in geographic coverage). Most often these same agencies hold regulatory authority over fish stocks. Due to its designation as the mandated marine research arm for the Commonwealth of Virginia, VIMS has a long history of conducting similar surveys in Chesapeake Bay and along the Virginia coast so we were able to build upon that historical knowledge base when constructing the NEAMAP survey. While certain disadvantages may exist, operating surveys from such an institution has several distinct advantages:

- Most importantly, academic institutions do not hold any regulatory authority thus there can be no question about whether there exists any conflict of interest between the management and research missions. This is not to say that any other agency or survey has or would purposely skew its survey results, but that removing the *perception* of a conflict of interest can be just as important as an actual conflict.
- Conducting a fishery independent monitoring survey necessarily involves repetitive sampling, month after month, year after year. This can sometimes lead to complacency among survey investigators and staff. While this can be true no matter where such a survey resides, at an academic institution there is more of a tendency to view such surveys not only in the context of repetitive sampling but also in the larger context of providing a platform upon which to continually expand the scope of work. This adds considerable value to the surveys and also provides for new and more interesting tasks for staff.
- Because they have to respond to the requirements of multiple funding organizations, frequently on short notice, academic research institutions are often far more nimble in routine management functions (e.g. hiring, purchasing, contracting) than traditional state or federal agencies.

### *NEAMAP Funding*

Our work is presently funded in what I believe to be a unique mechanism for large-scale survey work, namely through the Mid-Atlantic Fishery Management Council's (MAFMC) Research Set-Aside (RSA) program. This program was developed in previous Magnuson-Stevens authorization cycles. Under RSA, Councils can withhold (set aside) up to 3% of the total quota from certain species, to fund required research activities.

For each of the past five years, the MAFMC has granted us portions of the quotas for several species. For 2013 we own a total of about 2.5 million pounds of fish divided among five species.

Our annual grant is administered by NOAA, though *no federal dollars are expended*. We raise research dollars by auctioning off our quota in partnership with the National Fisheries Institute (NFI). Both commercial and charter industry captains can benefit from this auction because the RSA quota that they purchase can be used during closed seasons, thus increasing their profit and allowing us to use some of those extra dollars for research.

This market-based funding is appealing on many levels. For example:

- As previously stated, no federal dollars are expended (though considerable time is spent by federal authorities in grant processing, permit processing, and enforcement).
- Industry literally has 'buy-in' in regards to the funded projects.
- The total amount of research dollars available is more dependent on market conditions than on the federal budget.

For a number of reasons however, there are limitations on how widely this funding mechanism could be used to support more programs such as ours. These reasons include:

- The RSA quota must be harvested within the calendar year for which the project is granted. My Institute must 'front' approximately \$450,000 during the first half of each calendar year to pay for personnel, supplies, vessel charters, and so on before the first dollar is recovered from the auctioned fishes. Further, we are subject to varying market conditions. When we write our annual grant proposal we have to guess, about a year ahead of time, what the auction price will be for our RSA quota species, and then the fishermen have to guess at what their dockside sale price might be some months later when they harvest their RSA fishes. There is no guarantee that we will receive the anticipated research dollars. Many institutions could not support or would not allow such a situation.
- Because our program is so large and expensive, many other worthy and necessary projects are excluded from funding. Generally, after NEAMAP receives its quota assignments each year the remaining portions can support only one or two small projects. RSA was originally intended to fund smaller short term projects, not large long term monitoring.
- The RSA system depends upon there being more demand than supply for the fish species to be granted. In a future in which existed an overabundance of presently high value species such as summer flounder and black seabass, there would be little or no value in the RSA quotas.
- Similarly, if the portions of the quotas which could be used for RSA were to be increased, a situation could arise in which there was more RSA supply than demand. Only a subset of industry members can or will participate in raising RSA funds (e.g. through the NFI auction) so if there were more fish available than demand existed, the value of the quotas would decrease and the research could not be accomplished.

- Inequities can result from selling RSA quotas. Each pound of fish assigned to RSA is removed from the amounts available to the general industry and from recreational fishermen. Not all industry members can afford to participate in RSA fundraising or to wade through the required permitting process. People in the recreational sector may not feel the direct benefit of lowering their quota to support research.

The NEAMAP survey was not developed under the assumption that it would be funded by the MAFMC's RSA program. ASMFC intended that dedicated funding would be acquired but after it was recognized in 2006 that funding the NEAMAP survey was imperative, RSA was the only available mechanism. While the RSA system is currently working well for us, even in the depressed economy of recent years and even in a budgetary atmosphere in which many programs are seeing significant budget cuts, it is still a very unstable and unpredictable way to fund an ongoing, large scale, \$1 million per year program.

#### *NEAMAP Survey Data and Data Uses*

Our data have been examined for inclusion in all appropriate NEFSC and ASMFC assessments and assessment updates over the past two to three years. They have been incorporated as primary data sources for a smaller number of assessments. Where our data have not been included, it is universally due only to our still brief time series (six years). However, it is worth noting that our data have proved vital for both short-lived species such as Longfin squid and in NOAA's recent analyses of data on the extremely long-lived Atlantic sturgeon. Even for species for which our time series may still be too short, our biological data such as length-at-age have proven valuable. Further, our methodology for determining factors such as fish age for some species has forced a reexamination of the procedures used by other research groups. Our data have also been used by states to help set regulations such as size and creel limits.

While our catch processing and data processing methods necessarily differ from those used on surveys from NEFSC, the end-product data elements from the two surveys are virtually the same (except that there is almost no geographic overlap of the surveys). Each survey routinely produces assessment-related data such as:

- Overall and age-specific abundance indices, expressed either in numbers or biomass
- Length-frequencies, overall and by sex
- Geographic distribution (within the respective areas surveyed)
- Age-frequencies
- Sex ratios, overall or by size/age class
- Diets

It is worth noting that among large-scale surveys in the Northeast, the NEAMAP and NEFSC surveys (along with the ChesMMA survey that our research group also conducts within the confines of Chesapeake Bay), are the only ones that routinely record such extensive biological data elements. Due to logistical, manpower, and historical constraints, most surveys record only fish counts and length measurements (see *Recommendations* below).

#### *New Technologies*

As with every field of endeavor, technology is providing opportunities to collect more and better fishery-independent survey data and to provide it faster and more reliably. Affordable (given the importance attached to survey results) technologies exist to:

- Run scale model tank tests of fish trawls to determine the optimal shape while fishing. A fish trawl being used by a monitoring survey is a scientific sampling device and it should be viewed as being analogous to any piece of fine scale laboratory equipment. It must perform consistently.
- Allow researchers to constantly monitor the shape of their fish trawl to assure consistent performance within predetermined specifications as determined by the tank tests and to assure its proper deployment during each tow.
- Constantly monitor and record bottom type as the vessel conducts survey operations.
- Measure such parameters as temperature, salinity, depth, light intensity, pH, turbidity, and chlorophyll throughout the water column at locations where the trawls are deployed.
- Incorporate auto-sensing technologies using automatic recording of surface water quality parameters listed above using constant flow-through systems.
- Document fish behaviors in proximity to trawls using underwater cameras and other remote sensing technologies to move towards estimates of trawl capture efficiency.

A very exciting new technology which we plan to deploy later this year and in which we will collaborate with international partners from Norway, is a sophisticated camera and recording system which is installed near the aft end of a trawl and which documents the exact time when each specimen was captured. Fish can be identified to species and measured with surprising accuracy. A long list of research questions can be addressed with such technology, such as:

- Exactly when within a tow were specimens from each species captured?
- Within a tow, are some species typically captured together?
- For each species, are specimens typically captured in a group within a narrow time band or are they captured continuously throughout a tow?
- How long of a tow is long enough? A common criticism of monitoring surveys is that the tows are not long enough in duration to exhaust and capture larger specimens of some species. By fishing continuously over a very long duration and recording the exact time when each specimen is captured, this question can be addressed.
- Could adequate or even better data be obtained by fishing over long distances with an open-ended net, thus covering more ground but sacrificing fewer fish? This method would have to be supplemented with tows with a closed net to capture specimens for biological data (sex, maturity, age, diet, etc.).

### *Recommendations*

Any number of improvements could be made to the extant fishery independent surveys (as well as the development of new surveys) to improve the scientific underpinnings of the current fish stock assessment and management systems. Among the most important are:

- Encourage the standardization of sampling gears among surveys

The so-called “400x12cm 3-bridle 4-seam” trawl developed by the former NEFSC Trawl Advisory Panel for use on the *FSV Bigelow* and used by NEAMAP as well has proved to be a remarkably stable and efficient scientific sampling device. The gear has also been put into use by the Canadian Department of Fisheries and Oceans. Scaled down versions either have been or will be deployed in the Great Lakes and in Chesapeake Bay.

Changes in sampling gear would necessarily disrupt the time series of ongoing trawl programs. However, every survey must periodically go through such perturbations, often caused by unforeseen events such as loss of survey vessels or inability to purchase materials to construct or repair nets. It is better to plan for such events than to have them thrust upon you.

A change in sampling gear for some surveys would also provide an opportunity to reexamine issues such as stratification, site selection, standardized data recording systems, and related issues.

- Develop inter-survey and intra-survey calibrations.

Every survey trawl operates according to its particular design and has unique catch efficiency characteristics for each species. For some fish stock assessment mathematical models, these differences are immaterial, as each survey ‘index’ is treated independently. However, other models require relative catch rate efficiencies among surveys to be well documented. A mechanism to calibrate catch rates among surveys is to complete multiple side-by-side tows. Such experiments can be quite expensive.

- Encourage the maximization of the amounts and types of data recorded by fishery independent surveys.

As mentioned above, due to logistical and historical limitations, many existing surveys record only a small portion of the biological data elements potentially available. Often, only counts and length measurements are logged. It is our experience that obtaining each specimen is expensive (i.e. paying for vessel time and fuel, paying survey personnel, purchasing nets, computers and other supplies) but that the marginal cost of taking more data points from each specimen is small. Some surveys are limited by vessel space and available personnel though it is our experience that if something is considered important enough it can usually be accomplished.

Additional data elements which should be routinely recorded for the maximum possible number of species include:

- Species total and individual specimen weights
- Sex, maturity, and reproductive stage on a subsample of specimens
- Preservation of ageing structures (e.g. otoliths, vertebrae) for the maximum possible number of species.

- Preservation of fish stomachs for development of diet indices. These data are required to advance towards multi-species and ecosystem management.

Obtaining these types of data from as many sources as possible not only will lead to better stock assessments but will lead to a better understanding of the marine environment as a whole, thus providing the underpinnings for multi-species and ecosystem models and management.

- Develop regional fish ageing and fish diet centers.

Many state and regional surveys, as well as being constrained in the types of data they feel able to collect, also do not have the resources to process large numbers of biological samples that may be preserved during field operations. A series of laboratories, not necessarily centered only at federal facilities, where surveys could send such samples to be processed would not only significantly add to the types of data being collected but would assure a high level of standardization. Some organizations and institutions (my own being a good example) already have the infrastructure and knowledge bases to support such efforts so the step to becoming regional centers is one of scale rather than construction.

- Provide funding for surveys.

**Fish stock assessments and fishery regulations can be no better than the underlying data upon which they depend.** Fish stock assessment methods have become increasingly sophisticated and data intensive. Accurate, timely, and well-accepted assessments, as well as the subsequent setting of reasonable fishing regulations, depend upon accurate, timely, and well-accepted data. Fishery independent surveys are the primary unbiased source of data which inform us about the present status of most fish stocks.

**Under the current Magnuson law, lack of data literally means that fewer fish can be kept and that dollars will be lost to the fishing community.** Due to the Magnuson provisions dealing with uncertainty, when the Fishery Management Councils and their respective Scientific and Statistical Committees set their quotas, they must take into account the level of uncertainty inherent in the associated assessments. The higher the level of uncertainty, the lower the quota can be. Lack of data means lower catch, lower income, and fewer jobs.

Several references within this testimony speak to current logistical limitations as to what data can be collected by some surveys as well as to unpredictable or unstable funding sources for surveys. These limitations and instabilities (as well as accomplishing the other recommendations listed above) can only be addressed through additional funding.

While recognizing that providing such new funding is difficult within the parameters of the current federal budget, I simply state the need that efficient and effective fishery management requires it.



Figure 1. NEAMAP mid-Atlantic / Southern New England sampling area including region boundaries and depth strata.

